12.1.3 Macroinvertebrates

12.1.3.1 Quantitative Method (Hess or Surber Sampler)

A. EQUIPMENT

1. Hess or modified Hess sampler or surber sampler (approximately one square foot enclosure size - Hess is 0.1 square meters)

2. Collection jars (1 liter or 500ml wide-mouth polyethylene bottles)

3. Scrub brush

4. Squeeze bottle (one liter) for rinse water

5. Preservatives (ethanol and/or formalin)

6. A metal rod or long- shanked screwdriver for disturbing substrates with a Hess or Surber sampler.

B. COLLECTION

1. Since sampling locations have been predetermined based on the objectives of the study and reconnaissance visits, the selection of sampling sites is determined by the physical characteristics of the stream at the desired location (depth, velocity, substrate type, algae and macrophyte growth, predominance of pools, runs, and riffles, etc.). Although riffle areas with cobble substrates are generally the most diverse and productive habitat type, riffle areas may not represent the predominant type of habitat in the stream and may not be comparable to habitats sampled at other locations in the stream. The selection of habitats and sites to sample must be made carefully based on the objectives of the study.

2. Because this method is used to collect quantitative macroinvertebrate data, it is usually necessary to collect replicate samples so that statistical methods can be used in the analysis of data. Also, macroinvertebrate taxa are not usually uniformly distributed. Their distribution tends to be clumped or patchy, and often one or two samples shall not adequately represent the total macroinvertebrate population. In general, three to eight 1-square-foot samples per habitat type are considered sufficient for a faunal survey.

3. The site selected for sampling must possess certain physical attributes. The water must be deep enough to permit flow through the front and back screens into the catch net at the back of the sampler. However, the depth cannot be so great that water overflows the sampler, and washes organisms out the top. There also must be sufficient flow velocity to flush organisms into the collection net.

4. Once a site is selected, the Hess sampler is positioned for insertion into the substrate. While standing just downstream of the site, and facing upstream, grasp the sampler by the handles and hold it just above the water's surface, with the collection net on the

downstream side. Look through the top of the sampler to sight the substrate that shall be sampled. To compensate for the effect of the streamflow, an attempt is made to insert the sampler just upstream of the desired location.

5. Tipping the sampler slightly to elevate the front (upstream) end, and aiming slightly upstream of the desired site, drive the sampler into the water. When the bottom makes contact with the substrate, immediately drive the bottom of the sampler into the substrate using a series of quick, short, clockwise-counterclockwise rotations. Drive the sampler in as far as necessary to close any gaps between the substrate and the sampler bottom. If large cobbles or other objects prevent closure of the gap, an attempt may be made to remove these obstacles by hand. If the gap cannot be closed, preventing loss of organisms, a new site shall have to be selected.

6. Once the sampler is in place, the enclosed substrate is thoroughly churned and cleaned. Rocks and other debris should be brushed or cleaned so that any attached organisms are removed, making sure all collectible organisms and debris are kept inside the sampler. Cleaning and brushing continues until all organisms have been removed from the substrate. Finally, thoroughly churn the remaining bottom material with the metal rod or screwdriver, using a series of clockwise and counter clockwise rotations. The remaining bottom gravels and sands can also be scooped up with the hands and dropped, allowing any remaining organisms to be flushed into the net.

7. The contents of the collection net are washed down into the attached collection bottle. This may be done by removing the sampler from the substrate and letting water flow over the outside of the collection net while brushing organisms down the net with a hand or brush.

8. Dump the contents of the collection bottle into a one-quart (or smaller) sample jar. Remove as many organisms from the collection net and collection jar as is practical (a few shall inevitably be left behind) to preserve the integrity of the sample. Rinse and clean the collection net and sampler thoroughly to prevent contamination of the next sample.

9. Attach a label to the jar clearly identifying the sample (location, date, replicate number, method of collection and preservation). A small piece of paper with station identification number or name, written in pencil, may also be put into the jar to conclusively identify the sample.

C. FILTRATION None

D. PRESERVATION

Ethanol (ETOH) and formalin . Shoot for >70% ETOH in the final fixed sample. Only use formalin if it is absolutely necessary as it is a carcinogen. Decant excess water from the jar, using the lid to prevent loss of organisms. Fill the jar with ETOH. An ounce or two of formalin should be added if the sample contains a large amount of organic material (algae, detritus, wastewater treatment plant effluent, etc.) which could decompose and destroy macroinvertebrate organisms. Close jar securely.

E. PRECAUTIONS

1. Care must be taken in the transport or shipment of samples to prevent breakage of sample jars and loss of contents. Pack and store jars carefully and securely.

2. Care must be taken when looking for suitable sampling sites not to disturb the substrate or habitat in areas where samples might be collected. A sample collected where the substrate has been disturbed by walking shall not be representative of the community.

F. QUALITY CONTROL

There are no standardized quality control procedures in the collection and analysis of biological samples. Make sure samples are labeled accurately and completely.

G. SPECIAL INSTRUCTIONS None

H. REFERENCES

United States Geological Survey(USGS 1987). Techniques of Water Resources Investigations of the United States Geological Survey, Chapter A4. Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples, Washington, D.C.

I. PROJECT

Clark Fork Basin Study, Intensive Surveys

12.1.3.2 Semi-Quantitative Method

A. EQUIPMENT

1. D-net sampler

2. Collection jars (one Liter or 500 ml wide-mouth polyethylene bottles)

3. Preservatives (ethanol and/or formalin)

B. COLLECTION

1. As sampling locations have probably been predetermined based on the objectives of the study and reconnaissance visits, the selection of sampling sites is determined by the physical characteristics of the stream at the desired location (depth, velocity, substrate type, grass and macrophyte growth, predominance of pools, runs, and riffles, etc.). Although riffle areas with cobble substrates are generally the most diverse and productive habitat type, riffle areas may not be representative of the predominant type of habitat in the stream, may not be comparable to habitats sampled at other locations in the stream, and may not meet the objectives of the study.

2. If qualitative samples are desired, the sample collected may be a composite of many different habitat types (riffles, runs, pools, algae and macrophyte growth, cobble and sand substrates, etc.). Such a sampling attempts to collect and identify as many different taxa as possible residing in the stream reach. The method used to collect such a sample is called the traveling kick because the investigator moves around while collecting organisms from different sites (habitats) in the sampling location.

3. If semi-quantitative samples are desired, the investigator identifies an appropriate habitat to sample, and collects organisms using a similar amount of effort at all sites sampled. The amount of effort is standardized by disturbing a similar amount of habitat (i.e., substrate area) for a similar amount of time (i.e., 30 seconds). Because the effort is not as strictly controlled as in the use of a Hess sampler (thorough cleaning of a known area of substrate), the samples are not truly quantitative. The method used to collect semi-quantitative samples is called the unit-effort kick.

4. To collect a kick sample, the D-net is positioned in the stream so that the "flat" side of the hoop is snug against the substrate, approximately perpendicular to the line of flow. The net handle should also be approximately perpendicular to the water's surface.

5. An area in front of the net is disturbed, using one or both feet to loosen and churn the substrate. The churning and digging motions of the foot, or feet, should be vigorous enough to disturb the several top inches of substrate and loosen any tightly clinging organisms. If the sample is semi-quantitative, the area disturbed should be close to

some predetermined size (i.e., 1 or 2 square feet) and for some predetermined time (i.e., 30 seconds). Time and area of disturbance are not important in collecting qualitative samples, but collection sites should be disturbed thoroughly so that as many taxa as possible are collected.

6. Dump the contents of the net into a sample jar. Qualitative samples shall be composited as habitats and sites are sampled. Remove as many organisms as possible from the net. Rinse and clean the net thoroughly after each sample has been collected to prevent contamination of the next sample.

7. Attach a label to the jar clearly identifying the sample (location, date, replicate number, method of collection and preservation). A small piece of paper with station identification number or name, written in pencil, may also be put on the jar to conclusively identify the sample.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PLANNING, PREVENTION AND ASSISTANCE
(WORKING DRAFT)

RAPID BIOASSESSMENT MACROINVERTEBRATE PROTOCOLS: SAMPLING AND SAMPLE ANALYSIS SOP'S

Bob Bukantis
5 June, 1998

Please note that this is a working draft. This document outlines methods that are being refined and developed and expected to be in frequent revision. If you plan to use these methods, please acquire the latest version. Please contribute to the development process by directing any comments to Bob Bukantis; Monitoring and Data Management Bureau; Montana Department of Environmental Quality, 2209 Phoenix Ave, Helena MT 59601.

The methods described here are designed to be used in second order and above, wadable streams. These methods can also be used in smaller, e.g. first-order streams, but special care needs to be taken in data analysis and interpretation. The expectations or standards used to judge stream condition will vary from those presented here (Richards, 1996).

SAMPLING

INDEX PERIOD

Summer (June 21 to September 21), following runoff, is the season chosen by the Montana Department of Environmental Quality, Planning Prevention and Assistance Division (PPAD) for sampling macroinvertebrates in Montana. David Richards (1996) recommended limiting summer season sampling to July and August in his recent M.S. thesis on Montana mountain stream biomonitoring. The summer season is the time of year that PPAD has the most reference data, and it is the season in which both stream flows and weather conditions are most amenable to aquatic field work in Montana.

Extremes in flow should be avoided for sampling macroinvertebrates. Sampling during high flows, besides being potentially unsafe, is likely to increase sampling variance due to the difficulty in sampling in fast, deep waters using the methods described herein.

When monitoring for trends at a particular site, the best results will likely be obtained when potential between year variance is minimized by sampling as close as possible to the same date each year.

Specific monitoring or assessment information needs may dictate sampling outside of the recommended time period. In this case care should be taken that any reference data used for the assessment come from collections taken in as similar a time of year as the study collections. A preferable option would be to generate an expected community for comparison purposes specifically to address the needs of the study. For example, the best possible reference community when trying to determine the impact of a point source discharge will most likely be available upstream of the discharge at the time of sampling.

SITE SELECTION

Selection of study sites depends largely on the goals and objectives of the study. Site selection is best accomplished by an experienced aquatic ecologist. Access, location of contaminant sources, mixing zones, and dilution of pollutants, should be considered. A site selected as a reference for the study site should be as similar as possible to the study site. Care should be taken to sample from a riffle that is as typical as possible for the stream type especially when it is not possible to use locally-generated reference data. When there is a need to compare data from several sites, the sites selected for sampling should be as similar as possible in terms of gradient, depth, substrate size and heterogeneity, and canopy cover. It is best to avoid sampling near bridges, or crossings unless the purpose of the study is to examine the effects of these on the stream. There is ample evidence that the presence of lakes or impoundments on streams and rivers affects benthic invertebrate community composition; therefore sampling sites should be located as far from these as is practical. Sampling bedrock or large-boulder dominated riffles is best avoided, if practical.

SAMPLE COLLECTION

The goal using these methods should be to collect the widest variety of aquatic macroinvertebrates available at a site with a total sample size of at least 300 organisms while staying within the constraints of the methods.

Separate methods are outlined in this document for high- and low-gradient streams. A high-gradient stream is considered to be any stream that has riffles as a common feature. High gradient streams typically sustain water velocities of 1 ft/sec or greater and have substrates primarily composed of gravel or larger particles. Low-gradient streams are considered streams that either lack riffles or where riffles are a rare feature of the habitat. Low-gradient streams rarely have velocities that exceed 1 ft/sec, except during high water. Their beds are usually composed of fine sediment and may have intermittent patches of coarser materials. These low-gradient streams are usually prairie streams or spring creeks in Montana.

high-gradient streams

The high-gradient kick-net method is designed to sample stream riffles to collect a sample containing at least 300 macroinvertebrates.

The method was developed for sampling shallow riffles in second to fifth order (as defined by Strahler, 1957) Montana streams. When necessary, shallow runs or other habitats may be sampled. The habitat sampled should not be too deep (greater than 2 feet, ideally one foot or less), or too fast (greater than about 3 feet per second). The targeted sampling unit is a representative sampling of the microhabitats available within the riffle. A standard D-net with 1 mm mesh is used to collect the samples.

The sample is collected by employing a traveling kick technique where the objective is to dislodge the invertebrates so they are swept into the net. This is ideally done by starting at the downstream corner of a rock-substrate riffle and vigorously shuffling and kicking the feet through the substrate as you progress towards the opposite upstream corner of the riffle. Be sure to sample the margin of the riffle to collect those taxa unique to that microhabitat. While doing this "riffle shuffle" the D-net should be held such that the flat portion of the net ring is parallel to and on the bottom while the net opening is perpendicular to the current direction and immediately downstream of your feet. **The effort expended in acquiring the sample should be sufficient to capture at least 300 invertebrates and to effectively sample the variety of habitat in the riffle.** Attempt to move through the riffle at about one-third foot per second, so that the final **total length of stream-bottom disturbed is about 20 feet, and the total time spent sampling is one minute.** It may be necessary to adapt this technique to situations where a diagonal kick is not the best way to get a representative sample of the microhabitats in the riffle, or to get a sufficient number of organisms to process. For example, it may be better to break the "kick" up into shorter segments to ensure sampling a wider variety of microhabitats, or to deal with debris and sample material accumulations in the net-bag.

The samples are meant to be qualitative, although the duration of the kick should be timed and the length of stream bottom disturbed is estimated to allow for later estimation of a "catch-per-unit-effort". When samples are taken for trend monitoring and to be compared to samples that were taken using an earlier protocol, it is recommended that the original protocol be maintained to maintain consistency.

Replication of samples is recommended whenever possible. A recommended method is to sample two (or more) nearby riffles, keeping the samples separate. If samples are processed separately, variation introduced through the combined effects of sampling, subsampling, and site selection can be estimated. For the sake of brevity variation due to the three previously mentioned sources will be referred to herein as sampling variation.

An estimate of sampling variation is valuable in assessing impact and in assessing the significance of observed differences in impairment scores.

low-gradient streams

When riffles are rare or non-existent, as in low-gradient streams, a different sampling protocol is recommended. A multi-habitat approach has been developed for many areas of the United States and is considered to be an effective way of sampling macroinvertebrates in low-gradient streams. A dip-net "jab" sampling method will be employed. A single jab is meant to sample approximately 1 meter of length with the net; there should be 20 "jabs" per sample.

The sampling protocol is as follows:

1. **Select the reach to be sampled:** Select a reach of at least 1 meander length, or better, about 20 bankfull channel widths. Examine and record the approximate proportion of productive macroinvertebrate habitat. Productive habitat types are: riffles, snags, aquatic vegetation, and bank margins.
2. **Proportionally allocate jabs to the relative occurrence in the reach of habitat types.**
3. **Collect the 20 "jab" sample:** Sampling should be conducted moving in an upstream direction through the reach, proportionally allocating jabs among habitat types as determined in 2. above. Specific descriptions of what one jab should be for typical productive habitats are:
   - **riffles:** sample employing the traveling kick as for high gradient streams (explained above). Travel 1 meter for each "jab" allocated for riffle habitat. If the current is too slow to efficiently capture macroinvertebrates in the riffle using a traveling kick, then jab net along riffle bottom in an upstream direction, attempting to dislodge and catch invertebrates without retaining excessive debris.
   - **snags:** depends on the nature of the snag. The idea is to try to sample roughly an equivalent of a meter sweep. Sweep through and around the snag in such a way as to dislodge and capture inhabitants. Inhabitants should be scrubbed off by hand into the net on coarser snags.
   - **aquatic vegetation:** sweep the net through the vegetation for about 1 meter trying to loosen inhabitants.
   - **bank margins:** typically a modification/combination of "jab" recommended for the above habitats, depending on

the nature of the habitat at the site.

SAMPLE LABELING AND PRESERVATION

Accurate labeling of sample bottles is important to preserve critical information. Bottles are best labeled both inside and out. Labels to be placed in the sample bottle should be written in pencil on good quality paper labels. The use of pre-printed, fill-in-the-blank labels are recommended to help ensure that labeling is complete.

There are several suitable preservatives available. Ninety-five percent ethanol is a good choice. It will do the job, yet is relatively benign to handle. The drawback of using ethanol alone is that the fluid composition of the sample needs to be dominated by the ethanol to effect good preservation. It is necessary to consider the dilution effects of water present in living and dead biological material in the sample, as well as any free water. Attempt to get a final concentration of about 80 %. If there is any doubt concerning preservation, decanting and refreshing the sample with new ethanol once back from the field is recommended. Formalin is frequently used, either alone or in conjunction with ethanol. Formalin is a 37 to 40 % aqueous solution of formaldehyde. Two to 6 percent formalin will adequately preserve a sample. However, formalin is not "user friendly" as it is considered carcinogenic.

SUPPORTING FIELD DATA

Supporting data to be collected at the time of field sampling should be entered on the "field data sheet" and "habitat assessment field data sheet". Note that there are separate forms for both high-gradient (riffle-pool) and low-gradient (glide-run) streams. Both forms are adapted from the work of Mike Barbour and Sam Stribling of Tetra Tech. One set of forms should be filled out for each site sampled. In addition, the riffle or other habitats sampled should be described by the use of clearly written descriptions. A sketch of the riffle or other habitat sampled is recommended, along with an indication of that portion of the riffle sampled. A sketch is often invaluable when attempting to relocate sites in the future. Photographs should be taken of the sampling site, and of substrate sampled. Include landmarks in the photographs and sketches of the site to facilitate future location of the sampled site.

minimum field information required

The following is the minimal field information required to maintain data integrity. **Do not collect samples for processing without all of the following information included with the**

samples.

1. **Stream**: the name of the stream from where the sample was taken.
2. **Site name:** Use a descriptive site name that will help locate the sampled site.
3. **Date:** Date sample was taken.
4. **Time:** The time the sample(s) were taken (military time format).
5. **Collecting Agency:** The agency the sampler works for.
6. **Legal Description:** The Township, range, section and tract description to four divisions if possible. This information is required to build stations in the STOREASE database.
7. **Number of kick samples:** number of kick samples taken. Note if a sample is in more than 1 jar.
8. **Duration of kick:** Length of time substrate was disturbed to collect each sample. There should be a separate entry for each sample taken. The standard duration is one minute.
9. **Length of kick:** length of stream bottom disturbed during sample collection in feet. Should have an entry for each sample.
10. **Field notes:** Provide a description of the site(s) sampled. Provide any information that will help someone else locate where you took your samples.

habitat assessment forms

Rating the field characteristics can be highly subjective. Try to be as consistent as possible and freely take notes to document field conditions. The best use of the forms may be to force the sampler to observe and record certain aspects of the habitat encountered rather than an absolute scoring of the habitat condition.

Remember that the intention of the field forms is to facilitate the recording of information about quality of the stream as macroinvertebrate habitat. This is meant to be an aid in determining causes and sources of any impairment noted. The form is not designed to be used to separate out natural versus anthropogenic impacts to the stream system.

When sampling low gradient streams, detailed notes should be taken on the types and relative proportion of habitat sampled, as well as on description and condition of those habitats. Examples of information worth noting include: type of riffle substrate, number, type, and relative prevalence of macrophyte species, size of snags, accumulations of fine materials in channel and on/in habitats, etc.

Points to consider when rating macroinvertebrate habitat on the Habitat Assessment Forms are:

parameters 1 and 2: only rate that portion of the stream actually sampled; e.g. for riffle/pool streams only rate the riffle from which the sample was taken.

parameters 3-10 (and 7 and 9 on Glide/Run form): on this portion of the form rate the average condition observed for a distance about equal to 10-15 bankfull channel widths upstream of the sampling location. Make notes concerning any knowledge of conditions further upstream.

parameter 4: consider sediment to be any solid geologic material that is transported by the stream. Individual sediment particles range in size from microscopic (silt) to quite large, such as boulders.

parameter 5: Streams typically have three distinct channels. The bankfull channel is primarily formed by the bankfull discharge that is typically reached or exceeded about once every 1.5 years. When the flow exceeds the elevation of the top of the bankfull channel, the water expands into the flood channel (sometimes referred to floodplain, or flood-prone area). The baseflow channel is the channel that is defined by low-flow conditions. This is the smallest portion of the channel that is normally wet under all flow conditions. Diversion of water at dry times of the year or abnormally dry weather conditions may cause a reduction in the available habitat and have adverse effects on the macroinvertebrate community.

STREAM CHANNEL STABILITY DATA COLLECTION

SUBSAMPLING

Subsampling procedures need to be followed carefully to ensure reliable data that are directly comparable to other data collected using this method. The sample should be poured in a gridded pan with about 24 equal-sized squares. Distribute the sample as evenly as possible over the entire bottom of the pan. Randomly choose squares in the pan for subsampling. Remove all macroinvertebrates from each chosen square until 270 to 330 are picked. Once a square is chosen for sampling, search it for macroinvertebrates until you feel confident all macroinvertebrates have been removed. Be sure to record subsampling information to allow reporting the proportion of sample subsampled.

A lab should have a range of sizes of gridded pans available, such that an experienced "bug picker" can evaluate the proper size pan to use. The idea is to have the density of macroinvertebrates in the bottom of the pan so as to allow at least 5 squares, and preferably more, to be completely picked clean of macroinvertebrates without exceeding a total sample size of 330. It may be necessary with samples from rich sites to split the sample with a sub-sampling device that produces representative subsamples, prior to using the procedure described above.

Be sure to document the actual proportion of subsample removed so this can be used to produce a density estimate during data analysis.

MACROINVERTEBRATE TAXONOMIC RESOLUTION

It is critically important that the level of taxonomic resolution be strictly comparable to allow comparability of data between samples. When comparing data to data from past samples consistency of taxonomic resolution needs to be maintained or strictly accounted for in the analysis. The following taxonomic resolution is recommended for Montana.

Miscellaneous, Non-insect Invertebrates

Porifera, Turbellaria, Nematoda, Copepoda, and Ostracoda to class or phylum.

Acrai and Cladocera to Order

Oligochaeta to family.

Hirudinea to species

Mollusca: Family for Sphaeriidae, Planorbidae, Lymnaeidae, Ancylidae, Physidae.

Amphipoda, Astacidae, Isopoda (genus, except *Hyallela azteca* to species).

Odonata: genus

Ephemeroptera:

Baetidae: Genus for most, and species for *Baetis*. Generic limits suggested by McCafferty and Waltz (1990) followed.

Genus for Baetiscidae, Caenidae, Oligoneuriidae, Ephemeridae, Leptophlebiidae, Siphlonuridae, Tricorythidae.

Ephemerellidae: Genus except species for *Drunella* and *Timpanoga*.

Heptageniidae: Genus, except *Epeorus* to species

Plecoptera:

Family for Capniidae, Leuctridae and Chloroperlidae (except genus for *Kathroperla* and *Sweltsa*).

Nemouridae: Genus except for *Zapada* to species or species group.

Perlidae: Species except for *Doroneuria*.

Perlodidae, Pteronarcyidae, Peltoperlidae and Taeniopterygidae to genus.

Hemiptera: Genus, except Corixidae left at family level.

Megaloptera and Lepidoptera: Genus.

Trichoptera: Genus, except Rhyacophilidae to species group or species.

Coleoptera: Key to genus. List the larvae and adults separately in the taxonomic lists, where appropriate.

Diptera:

Blephariceridae, Ceratopogonidae, Culicidae, Dolichopodidae, Ephydridae, Muscidae, Pelecorhynchidae, Stratiomyiidae, Tabanidae, Tanyderidae to family. Larval and pupal identifications pooled under one family name.

Athericidae, Dixidae, Empididae, Psychodidae, Simuliidae, Tipulidae to genus. Larvae and pupae pooled under a single name.

Chironomidae:

Identified to genus level. Particular taxa (e.g. *Cricotopus nostococladius*) identified to subgenus or species group; combine pupae under family.

METRICS CALCULATED

The following are metrics that are considered poitentially useful for use in Montana:

Taxa Richness The number of clearly-unique taxa in the sample. Care needs be taken in this metric that taxa are not "double-counted". For example immature specimens determined to family only should be assumed to belong to the same genus as other specimens in that family that were determined to genus level, unless they are definitely known to belong to a different, but undetermined genus. Similarly, different life stages of an organism are not to be considered different taxa, unless the specimen in question is definitely known to represent a unique taxon. For example, finding chironomid pupae do not add an extra taxon to a list of chironomid genera, unless the specimens found are known to represent a "new" genus.

EPT Richness The number of taxa from the orders Ephemeroptera, Plecoptera, and Trichoptera. The same considerations applied to taxa richness above, apply here also.

% Dominant Taxon 100((number of individuals of the numerically dominant taxon)/(total in the sample)). Values range from 0 to 1.

Biotic Index The sum of (proportional abundance of a taxon in the sample)(tolerance values specified by DEQ for that taxon) for all taxa in the sample. Values range from 0 to 10.

Metals Tolerance Index (tolerance values specified by DEQ) calculated as Biotic Index, above.

% Collector-Gatherer + Filter-feeders The sum of the percentage of each of these functional-feeding groups in the sample.

% Scraper + Shredder (Mountain, Spring and Plains) The sum of the percentage of each of these functional-feeding groups in the sample.

Quantitative Similarity Index for Taxa Can be used only when comparing two samples. Caculate the amount of overlap in proportional abundance for each taxon, then sum this for all taxa in both samples. Values can range from 0 to 1.

Quantitative Similarity Index for Functional-Feeding-Groups Can be used only when comparing two samples. Caculate the amount of overlap in proportional abundance for each functional-feeding-group, then sum this for all taxa in both samples. Values can range from 0 to 1.

Dominants-in-Common-5 Can be used only when comparing two samples. It is the number of the five most numerically dominant taxa in each sample, that are also one of the five numerical dominants in both samples.

% EPT individuals The percentage of the sample made up of individuals from the orders Ephemeroptera, Plecoptera, and Trichoptera.

% Ephemeroptera The percentage of the sample made up of individuals from the order Ephemeroptera.

% Plecoptera (Mountain) The percentage of the sample made up of individuals from the order Plecoptera.

% univoltine The percentage of individuals in a smaple from taxa which typically complete their life cycles in 1 year.

% multivoltine The percentage of individuals in a smaple from taxa which typically complete their life cycles in more than 1 year.

% Baetidae of Ephemeroptera (Spring) The percentage of all Ephemeroptera indivduals in a sample from the family Baetidae.

Community Tolerance Quotient Calculated as Biotic Index, above, except using tolerance values from USDA Fisheries Habitat Surveys Handbook (R-4 FSH 2609.23). Values range from 0 to 108.

Shannon H (log base 2) See C.I. Weber, ed. 1973. Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents. US EPA 670-4-73-001. Cincinatti.

Number of Scraper Taxa The number of taxa from the scraper functional-feeding group.

Number of Predator Taxa The number of taxa from the predator functional-feeding group.

Number of Collector-Gatherer Taxa The number of taxa from the collector-gatherer functional-feeding group.

Number of Organisms Collected per Minute of sampling effort.

Number of Organisms Collected per Foot travelled during sampling.

The following metrics should be used only for interpretation of sources and causes of impairment, and not used in the calculation of impairment rating:

% Hydropsychinae of Total Trichoptera (Foothills and Mountain streams)
% Chironomidae (Foothill and Mountain streams)
% Scrapers + Shredders (Foothills)
% Plecoptera (Foothill and Spring)
% semivoltine

DATA ANALYSIS

Data analysis should generally follow methods for RBP III, as outlined in EPA's Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001), utilizing the metrics proposed herein. When comparison is being made between data sets, care must be taken to ensure consistency, especially in taxonomy and use of tolerance values.

Provisional criteria for metric scoring have been established for Montana wadable streams as follows:

SCORE:	**3**	**2**	**1**	**0**
		PLAINS		
Taxa Richness	>24	24-18	18-12	<12
EPT Richness	>8	8-6	5-3	<3
Biotic Index	<5	5-6	6-7	>7
% Dominant Taxon	<30	30-45	45-60	>60
% Collectors (g+ff)	<60	60-80	80-95	>95
% EPT	>50	50-30	30-10	<10
Shannon Diversity	>3.0	3.0-2.4	2.4-1.8	<1.8
% Scrapers + Shredders	>30	30-15	15-3	<3
# Predator Taxa	>5	4-5	3-4	<3
% Multivoltine	<40	40-60	60-80	>80

INTERMOUNTAIN VALLEY AND FOOTHILLS

Taxa Richness	>28	28-21	21-14	<14
EPT Richness	>14	14-13	12-11	<11
Biotic Index	<4	4-5	5-6	>6
% Dominant	<30	30-40	40-50	>50
% Collectors (g+ff)	<60	60-75	75-90	>90
% Scrapers + Shredders	>30	30-20	20-10	<10
% Hydropsychinae of Trichoptera	<75	75-85	85-95	>95
% EPT	>60	60-45	45-30	<30

MOUNTAIN

Taxa Richness	>28	28-24	24-19	<19
EPT Richness	>19	19-17	17-15	<15
Biotic Index	<3	3-4	4-5	>5
% Dominant	<25	25-35	35-45	>45
% Collectors (g+ff)	<60	60-70	70-80	>80
% Scrapers + Shredders	>55	55-40	40-25	<25
% EPT	>70	70-55	55-40	<40

Impairment scores are computed as follows:
1) Compute metrics.
2) Determine the score (0 to 3) from the tables above.
3) Sum the scores for all metrics, and divide this total by the maximum possible score (3 X (number of metrics used for scoring)).
4) the score resulting from step 3 will range from 0 to 1. Compare this score to the range of use support criteria below to determine use support rating.

The following are suggested water quality use support/standards violation thresholds, and are expressed as a score with range from 0 to 1:

>0.75	Full support--standards not violated
0.25-0.75	Partial support--moderate impairment--standards violated
<0.25	Nonsupport--severe impairment--standards violated

TREND ANALYSIS

When data is being analyzed for trends be sure to take account any differences in data analysis due to:

1. changes in methods.
2. level of taxonomic determination of the specimens.
3. differences in subsample size.
4. changes in taxonomy.
5. Rvisions in tolerance values.

Analysis for trends must be done carefully with regard for the above listed issues. Worthwhile trend analysis often requires complete reanalysis of the entire data set starting with the raw data. Never assume that metrics directly read from past reports are directly comparable to those you may have just calculated.

QUALITY ASSURANCE/QUALITY CONTROL

1. At least 10 % of macroinvertebrate samples should be replicated in the field. Suggested methods for replication are to sample 2 nearby riffles for high gradient streams, 2 nearby reaches for low-gradient streams.

2. Voucher collections should be submitted for all taxonomic identifications on samples.

3. When work is contracted out part of the agreement is based on an assessment of contractor competency. Therefore DEQ

will be consulted for agreement with decisions regarding selection of any subcontractor.

HABITAT ASSESSMENT

When habitat assessment scores are being compared between sites and/or years it is important to take into account the potential use of differing forms.

REPORTS

Reports written for the Montana Department of Environmental Quality following the methods described here require the following:

1. Taxonomic lists of macroinvertebrates, including tolerance values and functional feeding group designations used for each taxon. Taxa lists should include class, order, family, genus, and species designations where possible. Taxa lists should follow the taxonomic classification scheme used in Appendix 1. below to facilitate DEQ quality assurance activities.
2. Number pages on all reports, including appendices on unbound reports.
3. A clear summary of findings and conclusions. This should be a separate section of text, with a numbered list preferred.
4. Clearly document the dates samples were collected in any written report.
5. If an internal reference is developed for the analysis, describe the internal reference used.
6. Clear documentation of the proportion of sample subsampled.
7. Submit data both in hard copy and in electronic form. Below is a list of what needs to be included in the electronic format file and the order it must appear in order to be read into the database. The fields need to be in the order shown, pipe delimited, and in ASCII file format. All the data from each sample should be entered on one line. Note that fields 5, 8, 9, and 13, are filled in with G, B, 1, and MTK, respectively, when following the protocols outlined in this document. If you encounter a bug that does not have a code listed, please include a note that specifies the family, the genus and species and how many were found in the sample so we can enter the bug into our system and create a code for it. Fields 14 and 15 below would be repeated for each invertebrate taxon in the sample.

Field 1	Station key	5-DIGIT NUMERIC
Field 2	Project ID	NUMERIC
Field 3	Collecting Agency	NUMERIC
Field 4	Samples Analyzed by	NUMERIC
Field 5	**Sample Type**	**G**
Field 6	Collection Date	NUMERIC (00/00/00)

Field 7	Collection Time	NUMERIC (MILITARY TIME, Hrs, mins, as 00/00)
Field 8	**Depth Qualifier**	**B**
Field 9	**Mesh Size**	**1**
Field 10	Sub-sample percent	NUMERIC
Field 11	Duration of Kick	NUMERIC (IN SECONDS)
Field 12	Length of Kick	NUMERIC (IN FEET)
Field 13	**Biota Sampling Method**	**MTK**
Field 14	Biota Code (taxon)	M0000
Field 15	Result (count)	NUMERIC

REFERENCES

McGuire, D. 1994. Montana Nonpoint Source water quality investigations: 1992 macroinvertebrate assessments. Montana Department of Health and Environmental Sciences. open file document. 18 pages plus appendices.

McGuire, D. 1993. Clark Fork River Macroinvertebrate Biointegrity 1986 through 1992. Montana Department of Health and Environmental Sciences. open file document. 45 pages plus appendices.

McGuire, D. 1992. Montana Reference Streams Project: 1991 Aquatic Macroinvertebrate Surveys. Montana Department of Health and Environmental Sciences. open file document. 30 pages plus appendices.

Richards, D.C. 1996. The Use of Aquatic Macroinvertebrates as Water Quality Indicators in Mountain Streams of Montana. M.S. thesis. Montana State University, Bozeman. 166 pp.

Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena. 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

APPENDIX 1: MONTANA MACROINVERTEBRATE CHECK-LIST

Note: Tolerance values (metals and HBI) that are in bold are from: D. McGuire 1992, 1993, and 1994.

These documents are available at the Montana State Library.

TAXA LIST

CODE	TAXON	HBI	METALS	FFG	Volt
	MISCELLANEOUS TAXA (NON-INSECTS)				
M0591	PORIFERA				
M0535	CNIDARIA				
M0536	*Hydra*	**8**	**3**	P	
	PLATYHELMINTHES				
M0590	Turbellaria	**4**	**4**	P	M
M0608	Tricaldida				
	ASCHELMINTHES				
M0534	Nematoda	**5**	**5**		
	Mermithidae				
	ANNELIDA				
M0010	Oligochaeta	10		CG	
M0015	**Lumbriculidae**	**4**	**1**	CG	U
M0609	***Eclipidrilus***				

CODE	TAXON	HBI	METALS	FFG	Volt
M0012	**Enchytraeidae**	**4**	**1**	CG	U
M0017	**Naididae**	**8**	**5**	CG	M
M0018	*Chaetogaster diaphanus*	6		P	
M0019	*Nais communis*	8		CG	
M0020	*Nais variabilis*	10		CG	
M0021	*Ophidonais serpentina*	6		CG	
M0022	**Tubificidae**	**10**	**6**	CG	M
M0596	**Lumbricidae**	**4**	**1**	CG	U
M0013	Lumbricina				
M0001	Hirudinea	8		P	
M0002	**Erpobdellidae**	**8**	**4**	P	
M0005	**Glossiphoniidae**	**9**	**4**		
M0007	*Glossiphonia complanata*	**9**	**4**		
M0009	*Helobdella stagnalis*	**10**	**4**	P	U

	MOLLUSCA				
M0583	**Sphaeriidae**	**8**	**3**	FC	U
M0584	*Pisidium*	5,8		FC	
M0585	*Pisidium compressum*	8		FC	
M0586	*Pisidium milium*				
M0587	*Sphaerium*	5,8		FC	
M0588	*Sphaerium simile*				
M0555	**Ancylidae**			SC	
M0556	*Ferrissia*	**6**	**1**	SC	
M0557	*Ferrissia parallelus*				
M0558	*Ferrissia rivularis*	**6**	**1**	SC	
M0559	**Lymnaeidae**	**6**	**3**	SC	U
M0561	*Fisherola nutalli*	**3**	**1**		
M0562	*Fossaria*	**6**	**3**		
M0563	*Fossaria bulimoides cockerelli*				
M0565	*Fossaria modicella*				
M0566	*Stagnicola*	**6**	**3**	SC	
M0567	*Stagnicola elrodi*				

CODE	TAXON	HBI	METALS	FFG	Volt
M0568	**Physidae**	**8**	**3**	SC	U
M0569	*Physella*	**8**	**4**	SC	U
M0570	*Physella gyrina*				
M0571	*Physella lordi*				
M0572	*Physella propinqua nuttalli*				
M0573	**Planorbidae**	**6**	**3**	SC	U
M0574	*Gyraulus*	**8**	**3**	SC	
M0575	*Gyraulus parvus*	8		SC	
M0576	*Helisoma*	**6**			
M0577	*Planorbella subcrenatum*				
M0580	**Valvatidae**				
M0582	*Valvata humeralis*	**3**	**1**		
M0537	Cladocera				
M0538	Copepoda				
M0553	Ostracoda				
M0540	**Gammaridae**	**4**			
M0541	*Gammarus*	**4**	**1**	SH,CG	U
M0542	*Gammarus lacustris*				
M0543	**Talitridae**	8			
M0611	**Hyalellidae**				
M0545	*Hyallela azteca*	**8**	**3**	CG	U
M0546	**Isopoda**	**8**			
M0548	*Caecidotea*	**8**	**5**		
M0549	*Caecidotea racovitzai racovitzai*				
M0551	**Decapoda**	**6**	**3**	SH	S
M0552	*Pacifasticus*	**6**	**3**		
M0589	Acari	**5**	**5**		

	PHYLUM ARTHROPODA / CLASS INSECTA

M0328	**ODONATA**				
M0329	**Aeshnidae**	**5**		P	

CODE	TAXON	HBI	METALS	FFG	Volt
M0338	**Gomphidae**	2.5		P	
M0339	*Octogomphus*			P	
M0340	*Ophiogomphus*	**5**	**4**	P	S
M0341	*Ophiogomphus servus*	**5**			
M0343	**Libellulidae**	**9**		P	
M0330	**Calopterygidae**			P	
M0331	*Hetaerina americana*	**6**	**3**	P	
M0333	**Coenagrionidae**	**7**	**3**	P	
M0334	*Argia*	**7**		P	
M0335	*Coenagrion/Enallagma*	7		P	
M0336	*Enallagma*	**7**	**3**	P	
M0337	*Ischnura*	**7**	**3**	P	
M0342	**Lestidae**	**9**		P	

M0218	**EPHEMEROPTERA**				
M0219	**Baetidae**	**4**		CG,SC	
M0220	*Acentrella*	*4*		*CG*	
M0221	*Acentrella edmundsi*	**6**		CG	
M0222	*Acentrella insignificans*	**4**	**4**	CG	M
M0223	*Acentrella turbida*	**4**	**3**	CG	
M0224	*Baetis*	**5**	**4**	CG,SC	
M0225	*Baetis bicaudatus*	**2**	**4**		M
M0226	*Baetis propinquis*	**6**			
M0227	*Baetis (Psuedocloeon) punctiventris*	**6**	**3**		M
M0228	*Baetis tricaudatus*	**4**	**5**		M
M0229	*Callibaetis*	**9**	**1**	CG	
M0230	*Centroptilum*	**2**	**1**	CG,SC	
M0232	*Diphetor hageni*	**5**	**1**		
M0603	*Fallceon*				
M0233	**Caenidae**	**7**		CG,F,SC	
M0234	*Caenis*	**7**	**3**	CG,SC	
M0235	*Caenis latipennis*				
M0236	*Caenis youngi*				

CODE	TAXON	HBI	METALS	FFG	Volt
M0237	**Ephemerellidae**	**1**		CG,SC,P	
M0238	*Attenella*	2		CG	
M0239	*Attenella margarita*	**3**	**1**	CG	U
M0240	*Caudatella*	**0**		CG,SC	
M0241	*Caudatella edmundsi*				
M0242	*Caudatella heterocaudata*	**0**	**0**		
M0243	*Caudatella hystrix*	**0**	**0**		U
M0244	*Drunella*	1		SC,P	
M0245	*Drunella coloradensis*	**0**	**0**	P	U
M0246	*Drunella doddsi*	**1**	**0**	P	U
M0247	*Drunnella flavilinea*	**2**	**0**	SC	
M0248	*Drunella grandis*	**2**	**1**	SC	U
M0249	*Drunella spinifera*	**0**	**0**	**P**	U
M0250	*Ephemerella*	1.5		SC,CG	U
M0251	*Ephemerella alleni*	**1**			
M0252	*Ephemerella aurivillii*	0			
M0253	*Ephemerella inermis*	**4**	**3**		U
M0254	*Serratella*	**2**	**1**	CG	U
M0255	*Serratella mitchneri*	**0**		CG	
M0256	*Serratella tibialis*	**2**	**1**	CG	U
M0257	*Timpanoga*			CG	
M0258	*Timpanoga hecuba*	**2**	**1**	CG	U
M0259	**Ephemeridae**	**4**			
M0260	*Ephemera*	2.5		CG,P,F	
M0261	*Ephemera simulans*	**1**			
M0262	*Hexagenia*	6		CG,F	
M0263	*Hexagenia limbata*	**6**			
M0264	**Heptageniidae**	**4**		SC,CG	
M0265	*Cinygma*	**0**		SC,CG	U
M0266	*Cinygmula*	**0**	**0**	**SC,CG**	U
M0267	*Epeorus*	**2**	**0**	CG,SC	
M0268	*Epeorus albertae*	**2**	**0**		U
M0269	*Epeorus deceptivus*	**0**	**0**		U

CODE	TAXON	HBI	METALS	FFG	Volt
M0270	*Epeorus grandis*	**0**	**0**		U
M0271	*Epeorus longimanus*	**1**	**0**		U
M0272	*Heptagenia*	**4**	**1**	SC,CG	U
M0273	*Heptagenia soltari*	**3**	**1**		
M0274	*Ironodes*	**0**	**0**	SC,CG	U
M0733	Leucrocuta	1			
M0275	*Nixe*	**4**	**1**	SC,CG	U
M0276	*Nixe criddlei*	**2**			
M0277	*Nixe simplicoides*	**4**			
M0278	*Rhithrogena*	**0**	**2**	**CG,SC**	U
M0279	*Stenonema*	3.5		SC,CG	
M0280	*Stenonema terminatum*	**4**	**1**		
M0281	**Leptophlebiidae**	**2**		CG,SC	
M0282	*Choroterpes*	**2**	**1**	CG,SC	U
M0283	*Choroterpes albiannulata*	**2**	**1**		
M0284	*Leptophlebia*	**3**	**1**	CG	
M0285	*Paraleptophlebia*	**1**	**1**	CG,SH	U
M0286	*Paraleptophlebia bicornuta*	**2**	**1**		U
M0287	*Paraleptophlebia debilis*	**1**	**1**		
M0288	*Traverella*	**2**	**1**	CG,F	
M0289	*Traverella albertana*	**2**			
M0290	**Oligoneuridae**	2			
M0291	*Isonychia*	2.5		CG,F,P	
M0292	**Polymitarcyidae**	**2**			
M0293	**Siphlonuridae**	**1**		CG	
M0294	*Ameletus*	**0**	**1**	SC,CG	U
M0295	*Siphlonurus*	**2**	**1**	CG,SC,P, SH	
M0296	**Tricorythidae**	**4**		CG	
M0297	*Tricorythodes*	**4**	**4**	CG	M
M0298	*Tricorythodes minutus*	**4**	**4**		

M0344	**PLECOPTERA**				

CODE	TAXON	HBI	METALS	FFG	Volt
M0345	**Capniidae**	**1**	**0**	SH	U
M0346	**Chloroperlidae**	**1**		P,SC,CG	
M0599	*Chloroperlinae*	**1**	**2**	CG,P	U
M0347	*Kathroperla*	1	2	CG,SC	U
M0348	*Kathroperla perdita*	**1**	**2**		
M0349	*Sweltsa*	0		P	
M0350	**Leuctridae**	**0**	**0**	SH	U
M0351	*Paraleuctra*	2		SH	
M0352	**Nemouridae**	**2**		SH,CG	
M0353	*Amphinemura*	**2**	**1**	SH,CG	U
M0354	*Amphinemura banksi*	**2**			
M0602	*Malenka*	**1**	**1**		U
M0356	*Podmosta*	**2**	**1**		U
M0357	*Prostoia*			SH	
M0358	*Prostoia besametsa*	**3**		SH	
M0359	*Soyedina*				
M0360	*Soyedina pooteri*	**0**			
M0361	*Visoka cataractae*	**0**	**0**		U
M0362	*Zapada*	**2**		SH	U
M0363	*Zapada cinctipes*	**3**	**3**	SH	U
M0364	*Zapada columbiana*	**2**	**1**	SH	
M0365	*Zapada haysi*	**2**		SH	
M0366	*Zapada frigida*	**1**		SH	
M0367	*Zapada Oregonensis* Group	**2**	**1**	SH	U
M0368	**Perlidae**	**2**		P	
M0369	*Acroneuria*	.5		P	
M0370	*Acroneuria abnormis*	**2**		P	
M0372	*Calineuria californica*	**2**	**3**	P	S
M0373	*Claassenia*			P	
M0374	*Claassenia sabulosa*	**3**	**3**	P	S
M0375	*Doroneuria*	**0**	**2**	P	S
M0376	*Doroneuria theodora*	**0**		P	S
M0377	*Hesperoperla pacifica*	**1**	**3**	P	S

CODE	TAXON	HBI	METALS	FFG	Volt
M0378	**Perlodidae**	2		P,SC,CG	
M0380	*Cascadoperla trictura*	2			
M0381	*Cultus*	2	2	P	U
M0382	*Isogenoides*	3	2	p	U
M0383	*Isogenoides elongatus*	3		P	
M0384	*Isoperla*	2	3	P,CG	U
M0385	*Isoperla fulva*	3			
M0386	*Isoperla fusca*	0			
M0387	*Isoperla longiseta*	3			
M0388	*Isoperla mormona*	2			
M0389	*Isoperla petersoni*	1			
M0390	*Isoperla pinta*	2			
M0391	*Isoperla sobria*	2			
M0392	*Isoperla quinquepunctata*	2			
M0393	*Kogotus*	1	2	P,SC	U
M0394	*Megarcys*	1	1	P	U
M0396	*Perlinodes aurea*	1			
M0398	*Setvena bradleyi*	0	1	P,SC	
M0399	*Skwala*	3	3	P	U
M0400	*Skwala curvata*	2		P	
M0401	**Peltoperlidae**	0		SH,SC	
M0402	*Yoraperla*	0	0	SH,SC	U
M0403	**Pteronarcidae**	2		SH,SC,P	
M0404	*Pteronarcella*	4	4	SH,P	U
M0405	*Pteronarcella badia*	3	4	SH	
M0406	*Pteronarcys*	2	2	SH,P,SC	U
M0407	*Pteronarcys californica*	2	1		
M0408	**Taeniopterygidae**	2	1	SH,CG,SC	
M0410	*Doddsi occidentalis*	2			
M0411	*Taenionema*	2	2		
M0412	*Taenionema pacificum*	3			
M0299	**HEMIPTERA**				

CODE	TAXON	HBI	METALS	FFG	Volt
M0300	**Belastomatidae**	7		P	
M0301	*Lethocerus*			P	
M0302	**Corixidae**	10	**5**	PI,P,SC	
M0304	*Hesperocorixa laevigata*			PI	
M0305	*Palmacorixa*				
M0306	*Palmacorixa buenoi*				
M0307	*Palmacorixa gillettei*	**5**	**3**		
M0308	*Sigara*	**5**	**3**	PI,CG	
M0309	*Trichocorixa*			P,CG	
M0310	*Trichocorixa borealis*				
M0311	*Trichocorixa verticalis interiores*				
M0312	*Trichocorixa naias*				
M0313	*Trichocorixa verticalis*				
M0314	**Gerridae**	7		P	
M0315	*Gerris*	**5**	**3**	P	
M0316	**Mesoveliidae**	7		P	
M0317	*Mesovelia*			P	
M0318	**Naucoridae**	7		P	
M0319	*Ambrysus*	**3**	**3**	P	
M0320	**Notonectidae**	10		P	
M0321	*Notonecta*	**5**	**3**	P	

M0325	**MEGALOPTERA**	7			
M0326	**Sialidae**	**4**		P,CG	
M0327	*Sialis*	**4**	**4**	P,CG	

M0413	**TRICHOPTERA**				
M0414	**Brachycentridae**	**1**		CG,F,SH, SC	
M0416	*Amiocentrus aspilus*	**3**	**1**	CG	U
M0417	*Brachycentrus*	**1**		FC,SC	
M0418	*Brachycentrus americanus*	**1**	**4**		U
M0419	*Brachycentrus occidentalis*	**2**	**3**		U

CODE	TAXON	HBI	METALS	FFG	Volt
M0420	*Micrasema*	**1**	**2**	SH,CG	U
M0421	*Micrasema bactro*	**1**	**2**		
M0422	**Glossosomatidae**	**0**	**2**	SC,CG	U
M0423	*Agapetus*	**0**	**2**	SC,CG	U
M0424	*Agapetus montanus*				
M0425	*Anagapetus*	**0**		SC	
M0426	*Culoptila*	**1**		SC	
M0427	*Glossosoma*	**0**	**2**	SC	U
M0428	*Glossosoma traviatum*			SC	
M0429	*Glossosoma velona*			SC	
M0430	*Protoptila*	**1**	**2**	SC	
M0431	**Helicopsychidae**	**3**	**3**	SC	
M0432	*Helicopsyche*	**3**	**3**	SC	
M0433	*Helicopsyche borealis*	**3**	3	SC	U
M0434	**Hydropsychidae**	**4**		FC,P	
M0605	**Arctopsychinae**	**2**		FC	
M0435	*Arctopsyche*	**2**	**3**	FC	U
M0436	*Arctopsyche grandis*	**2**	**3**	FC	U
M0452	*Parapsyche*	**0**	**1**	FC	U
M0453	*Parapsyche elsis*				
M0606	**Hydopsychinae**			FC	
M0438	*Cheumatopsyche*	**5**	**5**	FC	U
M0439	*Hydropsyche*	**5**	**5**	FC	U
M0437	*Ceratopsyche*	**5**	**5**	FC	U
M0440	*Hydropsyche bidens*	**3**		FC	
M0441	*Hydropsyche (Ceratopsyche) bronta*	**5**	**4**	FC	
M0442	*Hydropsyche (C.) cockerelli*	**4**	**4**	FC	
M0443	*Hydropsyche (C.) morosa*	**6**	**5**	FC	
M0444	*Hydropsyche occidentalis*	**5**	**5**	FC	
M0445	*Hydropsyche (C.) oslari*	**4**	**6**	FC	
M0446	*Hydropsyche placoda*	**3**	**5**	FC	
M0447	*Hydropsyche separata*	**4**		FC	
M0448	*Hydropsyche simulans*	**7**		FC	

CODE	TAXON	HBI	METALS	FFG	Volt
M0449	*Hydropsyche (C.) slossonae*	**4**	**6**	FC	
M0450	*Hydropsyche (C.) tana*	**3**		FC	
M0451	*Hydropsyche (C.) vexa*	**3**		FC	
M0454	**Hydroptilidae**	**4**		PI,SC,CG	
M0455	*Agraylea*	**8**	**2**	PI,CG	M
M0456	*Hydroptila*	**6**	**4**	PI,SC	M
M0457	*Ithytrichia*	**3.5**		SC	
M0458	*Ithytrichia clavata*				
M0459	*Leucotrichia*	**2**	**1**	SC,CG	U
M0460	*Leucotrichia pictipes*	**2**	**1**		
M0461	*Mayatrichia*	**1**		SC	
M0462	*Neotrichia*	**2**	**2**	SC	
M0463	*Ochrotrichia*	**4**	**3**	PI	U
M0464	*Oxyethira*	**3**	**2**	PI,CG,SC	
M0465	*Zumatrichia*	**3**		SC,CG	
M0466	*Zumatrichia notosa*	**3**	**1**	SC,CG	
M0467	**Lepidostomatidae**	**1**		SH	
M0468	*Lepidostoma*	**1**	**1**	SH	U
M0469	*Lepidostoma*-panel case			SH	
M0470	*Lepidostoma*-sand case			SH	
M0471	*Lepidostoma*-turret case			SH	
M0472	**Leptoceridae**	**4**		CG,SH,P	
M0473	*Ceraclea*	**3**	**1**	CG,SH,P	
M0474	*Mystacides*	**4**	**3**	CG,SH	
M0475	*Nectopsyche*	**2**	**3**	SH,CG,P	U
M0476	*Oecetis*	**8**	**3**	P,SH	U
M0477	*Triaenodes*	**6**	**1**	SH	
M0478	**Limnephilidae**	**3**		SH,CG,SC,P	
M0479	*Apatania*	**3**	**2**	SC,CG	U
M0481	*Chyranda*	**2**	**2**	SH	U
M0482	*Chyranda centralis*	**2**		SH	
M0483	*Cryptochia furcata*	**1**			

CODE	TAXON	HBI	METALS	FFG	Volt
M0484	*Dicosmoecus*	**2**	**1**	SC,SH,P	S
M0485	*Dicosmoecus atripes*				
M0486	*Ecclisomyia*	**4**	**2**	CG,SC	U
M0487	*Glyphopsyche*	1			
M0488	*Glyphopsyche irrorata*	**1**			
M0489	*Hesperophylax*	**3**		SH,SC,CG	
M0490	*Homophylax*	**2**		SH	
M0491	*Limnephilus*	**3**	**2**	SH,CG	
M0492	*Neophylax*	**3**	**2**		U
M0493	*Onocosmoecus*	**3**	**2**		
M0494	*Psychoglypha*	**0**	**2**	CG,SH	U
M0495	*Psychoglypha bella*				
M0496	**Molannidae**	**6**		SC,CG,P	
M0497	**Philopotamidae**	**3**		FC	
M0498	*Chimarra*	3.5		FC	
M0499	*Chimarra utahensis*	**4**		FC	
M0500	*Dolophilodes*	**0**	**1**	FC	U
M0501	*Wormaldia*	**0**	**1**	FC	U
M0502	*Wormaldia gabriella*	**0**		FC	
M0503	**Phryganeidae**	**4**		SH,SC	
M0504	**Polycentropodidae**	**6**		FC,P,SH	
M0505	*Neureclipsis*	**7**		FC,SH,P	
M0506	*Nyctiophylax*	**5**			
M0507	*Polycentropus*	**6**	**1**	P,FC	U
M0508	**Psychomyiidae**	**2**		CG,SC	
M0509	*Psychomyia*	**2**	**1**	CG,SC	
M0510	*Psychomyia flavida*	2			
M0511	**Rhyacophilidae**	**0**		P,CG,SC	
M0512	*Rhyacophila*	1		P,CG,SC	
M0513	*Rhyacophila Alberta* Group	**0**	**1**		U
M0514	*Rhyacophila Angelita* Group	**0**	**1**		U
M0515	*Rhyacophila Betteni* Group	**0**	**1**		U
M0516	*Rhyacophila Brunnea* Group	**2**	**1**		U

CODE	TAXON	HBI	METALS	FFG	Volt
M0517	*Rhyacophilla brunnea*	0			
M0518	*Rhyacophila Coloradensis* Group	**0**	**1**		S
M0519	*Rhyacophila coloradensis*	**0**			
M0520	*Rhyacophila Hyalinata* Group	**0**	**1**		U
M0521	*Rhyacophila Iranda* Group	**0**			
M0522	*Rhyacophila narvae*	**0**			
M0523	*Rhyacophila pellisa*	**0**			
M0524	*Rhyacophila Sibirica* Group	**0**	**1**		U
M0525	*Rhyacophila Vemna* Group	**0**			
M0526	*Rhyacophila verrula*	**0**	**1**		U
M0527	*Rhyacophila Vofixa* Group	**0**	**1**		U
M0528	**Uenoidae**			SC,CG	
M0529	*Neophylax*	**3**	**2**	SC	
M0530	*Neophylax rickeri*				
M0531	*Neothremma*	**1**	**1**	SC,CG	U
M0532	*Neothremma alicia*				
M0533	*Oligophlebodes*	**3**	**1**	SC,CG	U

M0322	**LEPIDOPTERA**	7			
M0323	**Pyralidae**	**5**		SH,SC	
M0324	*Petrophila*	**5**	**3**	SC	U

M0023	**COLEOPTERA**				
M0024	**Curculionidae**			SH	
M0025	**Dryopidae**	**5**		SH,SC,CG	
M0026	*Helichus*	**2**	**2**		U
M0027	**Dytiscidae**	5	**7**	P	U
M0028	*Agabus*	**5**	**7**	P	
M0029	*Deronectes*	**5**	**7**	P	
M0030	*Oreodytes*	**5**	**7**	P	
M0031	**Elmidae (L)**	**4**		CG,SC,SH	
M0032	**Elmidae (A)**	**4**		CG,SC,SH	

CODE	TAXON	HBI	METALS	FFG	Volt
M0033	*Cleptelmis*	4			
M0034	*Cleptelmis ornata*	**4**	**4**		U
M0035	*Dubiraphia* (L)	**6**	**4**		
M0036	*Dubiraphia* (A)	**6**	**4**		U
M0037	*Heterlimnius*	**3**	**3**		U
M0038	*Heterlimnius corpulentus*	**3**	**3**		
M0039	*Lara*	**1**	**1**	SH	U
M0040	*Lara avara*	**1**	**1**	SH	
M0041	*Microcylloepus*	**5**	**4**		U
M0042	*Microcylloepus browni*				
M0043	*Microcylloepus pusillus* (L)	**5**	**3**		
M0044	*Microcylloepus pusillus* (A)	**5**	**3**		
M0045	*Narpus*	**2**	**1**		
M0046	*Narpus concolor*	**2**	**1**		U
M0047	*Optioservus* (L)	**5**	**5**	SC,CG	U
M0048	*Optioservus* (A)	**5**	**5**	CG,SC	U
M0049	*Optioservus divergens*	4			
M0050	*Optioservus quadrimaculatus*				
M0051	*Optioservus seriatus*				
M0052	*Ordobrevia*	**5**	**3**		
M0610	*Phanocerus*				
M0053	*Stenelmis* (L)	**5**	**3**	SC,CG	
M0054	*Stenelmis* (A)	**5**	**3**	CG,SC	
M0055	*Stenelmis oregonensis*	**5**			
M0056	*Zaitzevia*	5			
M0057	*Zaitzevia parvula*	**4**	**3**		U
M0058	*Zaitzevia thermae*				
M0059	**Gyrinidae**	10		P	
M0060	*Gyrinus*	**5**	**3**	P	U
M0061	**Haliplidae**	**7**	**7**	SH,PI,P, SC	
M0062	*Brychius*	**5**	**5**	SC,PI	U
M0063	*Haliplus*	5		PI,SH	
M0064	*Peltodytes*	5			

CODE	TAXON	HBI	METALS	FFG	Volt
M0065	**Heteroceridae**				
M0066	**Hydrophilidae**	**5**	**7**	P,CG,PI, SH	U
M0067	*Berosus* (L)	5		P	
	Berosus (A)			CG	
M0069	*Hydrochus*	7		SH	
M0070	**DIPTERA**				
M0071	**Athericidae**	**2**			
M0072	*Atherix*	**5**	**5**	P	U
M0073	*Atherix pachypus*	**4**	**4**	P	
M0074	**Blephariceridae**	**0**		SC	U
M0076	*Bibiocephala grandis*			SC	
M0077	**Ceratopogonidae**	**6**	**5**	P,CG,SC	
M0078	*Culicoides*	**10**		P,CG	
M0598	Ceratopogoninae	**6**	**4**	P,CG	M
M0079	**Chaoboridae**	**8**		P	
M0080	**Chironomidae**	10		CG,F,P,SH,SC ,PS	
M0607	**Chironominae**	**8**		CG,F,SH	
M0082	*Chironomus*	**10**	**4**	CG,SH	
M0083	*Cryptochironomus*	**8**	**5**	P	M
M0084	*Cryptotendipes*	**6**			
M0085	*Demicryptochironomus*	**8**	**4**	CG	
M0086	*Dicrotendipes*	**8**	**5**	CG,F,SC	
M0087	*Endochironomus*	**10**	**6**	SH,FC,CG	
M0088	*Glyptotendipes*	**10**		SH,FC,CG	
M0089	*Microtendipes*	**6**	**4**	FC,CG	
M0090	*Parachironomus*	**10**	**4**	P,CG	
M0091	*Paracladopelma*	**7**	**4**		
M0092	*Paralauterborniella* (=*Apedilum*)	8		CG	
M0093	*Paratendipes*	**10**		CG	
M0094	*Phaenopsectra*	**7**	**4**	SC,CG,F	
M0095	*Polypedilum*	**6**	**4**	SH,CG,F,P	M

CODE	TAXON	HBI	METALS	FFG	Volt
M0096	*Pseudochironomus*	**5**	**4**	CG	
M0097	*Robackia*	**4**	**4**	CG	M
M0098	*Saetheria*	4		CG	
M0099	*Stenochironomus*	**5**		CG,SH	
M0100	*Stictochironomus*	**5**		CG,SH	
M0101	*Xenochironomus*	**4**	**0**	P	
M0102	**Tanytarsini**	**6**		FC,CG,SC	
M0103	*Cladotanytarsus*	**7**	**3**	CG,F	
M0104	*Micropsectra*	**4**	**1**	CG	
M0105	*Paratanytarsus*	**6**	**2**		
M0106	*Rheotanytarsus*	**6**	**1**	FC	M
M0107	*Stempellina*	**2**	**0**	CG	
M0108	*Stempellinella*	**4**			
M0109	*Sublettea*				
M0110	*Tanytarsus*	**6**	**3**	FC,CG,SC	M
M0111	**Tanypodinae**	**7**		P,CG	
M0604	*Alotanypus*	**6**	**8**	P,CG	
M0112	*Ablabesmyia*	**8**	**3**		
M0113	*Apsectrotanypus*	**8**		P	
M0114	*Brundiniella*	**3**	**7**	P	
M0115	*Conchapelopia/Thienemannimyia*			*P*	
M0116	*Labrundinia*			P	
M0117	*Larsia*	**6**	**3**	P	
M0118	*Macropelopia*	**6**	**5**	P	
M0119	*Pentaneura*	**6**	**2**	P,CG	
M0120	*Procladius*	**9**	**5**	P,CG	
M0121	*Psectrotanypus*	**10**		P	
M0122	*Tanypus*	**10**		P,CG	
M0123	*Thienemannimyia*	**5**	**3**	P	M
M0124	*Zavrelimyia*	**8**		P	
M0125	**Diamesinae**	**5**		CG,SC	
M0126	*Diamesa*	**5**	**9**	CG,SC	M
M0127	*Pagastia*	**1**	**9**		M

CODE	TAXON	HBI	METALS	FFG	Volt
M0128	*Potthastia*	**2**	**5**	CG,SC	M
M0129	*Potthastia Gaedii* Group	**2**	**5**		
M0130	*Potthastia Longimana* Group	**2**	**5**		
M0131	*Psuedodiamesa*	**2**		CG	
M0132	*Sympotthastia*	**2**		CG,SC	
M0133	**Prodiamesinae**	3		CG	
M0134	*Monodiamesa*	**7**	**5**	CG	
M0135	*Odontomesa*	**4**	**5**	CG	
M0136	*Prodiamesa*	**3**	**3**	CG	
M0137	**Podonominae**	**1**		CG,SC	
M0138	*Boreochlus*	**1**		CG,SC	
M0139	*Parochlus*	**1**		CG,SC	
M0140	**Orthocladiinae**	**6**		CG,SC,SH,P,PS	
M0142	*Acricotopus*				
M0143	*Brillia*	**4**	**4**	SH,CG	M
M0144	*Cardiocladius*	**5**	**9**	P	M
M0145	*Chaetocladius*			CG	
M0146	*Corynoneura*	**7**	**4**	CG	M
M0147	*Cricotopus*	**7**	**9**	SH,CG	M
M0148	*Cricotopus Cricotopus*				
M0149	*Cricotopus Isocladius*				
M0150	*Cricotopus Nostococladius*	**6**	**5**		M
M0151	*Cricotopus Tremulus* Group				
M0152	*Cricotopus Trifascia* Group	7			
M0153	*Diplocladius*	**5**		CG	
M0154	*Eukiefferiella*	**8**	**9**	CG,SC,P	M
M0155	*Eukiefferiella devonica* Group	**8**	**7**		
M0156	*Krenosmittia*	**1**		CG	
M0157	*Heterotrissocladius*	**0**		CG,SC	
M0158	*Hydrobaenus*	**8**		SC,CG	
M0159	*Lopescladius*	**2**		CG	
M0160	*Nanocladius*	**3**	**4**	CG	M
M0161	*Orthocladius*	**6**	**5**	CG	M

CODE	TAXON	HBI	METALS	FFG	Volt
M0162	*Paracladius*	**8**		CG	
M0163	*Parakiefferiella*	**6**		CG	
M0164	*Parametriocnemus*	**5**	**4**	CG	M
M0165	*Paraphaenocladius*	**4**	**4**	CG	M
M0166	*Psectrocladius*	**8**		CG,SH	
M0167	*Pseudorthocladius*	**0**		CG	
M0168	*Pseudosmittia*	**6**	**4**		M
M0169	*Rheocricotopus*	**4**	**5**	CG,SH,P	M
M0170	*Stilocladius*				
M0171	*Symbiocladius*	**4**	**1**	PS	
M0172	*Synorthocladius*	**2**	**1**	CG,SC	M
M0173	*Thienemanniella*	**6**	**4**		M
M0174	*Tvetenia*	**5**	**4**	CG	M
M0175	**Culicidae**	10		CG,FC	
M0176	*Aedes*	**7**	**5**	CG,F	
M0177	*Anopheles*			FC	
M0178	**Deuterophlebiidae**	0			
M0179	*Deuterophlebia*	**0**	**0**	SC	M
M0180	**Dixidae**	**4**		CG	
M0182	**Dolichopodidae**	**4**	**4**	P,CG	
M0183	**Ephydridae**	**6**		CG,SH,SC, P	
M0184	**Empididae**	**6**	**6**	P,CG	U
M0185	*Chelifera*	**5**	**4**		U
M0186	*Clinocera*	**5**	**4**		U
M0187	*Hemerodromia*	**6**	**4**	P,CG	U
M0188	*Oreogeton*	**4**	**7**	P	
M0189	**Muscidae**	10		P	
M0190	*Limnophora*	**6**	**7**	P	
M0191	**Pelecorhynchidae**	**1**		P,SH	
M0192	**Psychodidae**	4		CG,SC	
M0597	*Pericoma*	**4**	**4**	CG	U
M0193	**Simuliidae**	**6**		FC,SC	
M0194	*Cnephia*	**1**		FC	

CODE	TAXON	HBI	METALS	FFG	Volt
M0195	*Prosimulium*	**4**	**2**	FC	M
M0196	*Simulium* (*Eusimulium*)	**5**	**5**	FC	M
M0198	*S.* (*Psilozia*)	**7**	**7**	FC	M
M0199	*Twinnia*	**7**		SC	
M0200	**Stratiomyiidae**	**7**	**4**	CG,SC	U
M0201	*Euparyphus*	**7**	**4**	CG,SC	
M0202	**Tabanidae**	**6**	**3**	P	
M0203	**Tanyderidae**	**5**			
M0204	*Protanyderus*	**5**	**1**		
M0205	**Tipulidae**	**3**		SH,CG,P	
M0206	*Antocha*	**3**	**4**	CG	U
M0207	*Dicranota*	**3**	**2**	P	U
M0208	*Erioptera*	**7**		CG	
M0209	*Hesperoconopa*	**1**	**1**		
M0210	*Hexatoma*	**2**	**2**	P	U
M0211	*Limnophila*	**3**		P	
M0212	*Ormosia*	**6**	**2**	CG	
M0213	*Pedicia*	**6**		P	
M0214	*Pilaria*	**7**		P	
M0215	*Pseudolimnophila*	**2**	**4**	CG	U
M0216	*Rhabdomastix*	**1**	**1**		U
M0217	*Tipula*	**4**	**4**	SH	U

FIELD LIST

____MACROINVERTEBRATE SAMPLE BOTTLES
____LABEL MARKERS
____LABELS
____TAPE
____LABELS TO PUT INTO BOTTLES
____NETS
____FIELD DATA SHEETS
____CAMERA
____FILM
____ETHANOL or other preservative
____PAN OR BUCKET (not necessary, but can aid quick sample examination)
____PENCILS
____CLIPBOARD(S)
____FIELD METER(S)
____CALIBRATION BUFFER
____DI WATER
____THERMOMETERS
____HIP BOOTS
____MAPS
____GPS unit
____SITE INFORMATION, (location, sampling effort etc)
____BATTERIES
____ TAPE RECORDER (for field notes on the fly)
____ FIELD NOTEBOOK
______ SURVEY GEAR (level, rod, tape)
______ REBAR (or other to mark permanent cross-sections)

HABITAT ASSESSMENT FIELD DATA SHEET — RIFFLE /POOL PREVALENCE

Stream ________________________________ Site ____

Date __________________________________ Investigator _________________________________

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
1A. Riffle Development SCORE (____)	Well-developed riffle; riffle as wide as stream and extends two times width of stream. 9-10	Riffle as wide as stream but length less than two times width. 6-8	Reduced riffle area that is not as wide as stream and its length less than two times width. 3-5	Riffles virtually non-existent 0-2
1B. Benthic Substrate SCORE (____)	Diverse Substrate dominated by cobble. 9-10	Substrate diverse, with abundant cobble but bedrock boulder, fine gravel, or sand prevalent. 6-8	Substrate dominated by bedrock, boulders, fine gravel, sand or silt; cobble present. 3-5	Monotonous fine gravel, sand, silt or bedrock substrate. 0-2
2. Embeddedness SCORE (____)	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35mm [.25"]) 16-20	Gravel, cobble, or boulder particles are between 25-50% surrounded by fine sediment. 11-15	Gravel, cobble, or boulder particles are between 50-75% surrounded by fine sediment. 6-10	Gravel, cobble, or boulder particles are over 75% surrounded by fine sediment. 0-5
3. Channel Alteration (channelization, straightening, dredging, other alterations) SCORE (____)	Channel alterations absent or minimal; stream pattern apparently in natural state. 16-20	Some channelization present, usually in areas of crossings, etc, evidence of past alterations (before past 20 yr) may be present, but more recent channel alteration is not present. 11-15	New embankments present on both banks; and 40 to 80% of the stream reach channelized and disrupted. 6-10	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. 0-5
4. Sediment Deposition SCORE (____)	Little or no enlargement of bars and less than 5% of the bottom affected by sediment deposition. 16-20	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 11-15	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition in pools prevalent. 6-10	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 0-5

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
5. Channel Flow Status SCORE (____)	Water fills baseflow channel; minimal amount of channel substrate exposed. 16-20	Water fills >75% of the baseflow channel; <25% channel substrate exposed. 11-15	Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed. 6-10	Very little water in channel, and mostly present as standing pools. 0-5
6. Bank Stability (Score each bank) Note: determine left or right side while facing downstream. SCORE (____) (left) SCORE (____) (right)	Banks stable; no evidence of erosion or bank failure; little apparent potential for future problems. 9-10	Moderately stable; infrequent, small areas of erosion mostly healed over. 6-8	Moderately unstable; moderate frequency and size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow. 3-5	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of banks have erosion scars on side-slopes. 0-2
7. Bank Vegetation Protection (note: reduce scores for annual crops and weeds which do not hold soil well, eg knapweed) SCORE (____) (left) SCORE (____) (right)	Over 90% of the streambank surfaces covered by stabilizing vegetation; vegetative disruption minimal or not evident; almost all plants allowed to grow naturally. 9-10	70-90% of the streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than one-half of potential plant height evident. 6-8	50-70% of the streambank surfaces covered in vegetation; dsiruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of potential plant height remaining. 3-5	Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less. 0-2
8. Vegetated Zone Width (score zone for each side of stream) SCORE (____) (left) SCORE (____) (right)	Width of vegetated zone >100 feet. 9-10	Width of vegetated zone 30-100 feet. 6-8	Width of vegetated zone 10-30 feet. 3-5	Width of vegetated zone <10 feet. 0-2

TOTAL SCORE (____)

MOD 5/16/95

HABITAT ASSESSMENT FIELD DATA SHEET — GLIDE / POOL PREVALENT STREAMS

Stream ____________________ Date ____________________

Site ____________________ Investigator ____________________

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
1. Bottom Substrate / Available Cover SCORE (____)	Greater than 50% mix of snags, submerged logs, undercut banks, rubble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient). 16-20	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). 11-15	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. 6-10	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. 0-5
2. Pool Substrate Characterization SCORE (____)	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. 16-20	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. 11-15	All mud or clay or sand bottom; little or no root mat; no submerged vegetation. 6-10	Hard-pan clay or bedrock; no root mat or vegetation. 0-5
3. Pool Variability SCORE (____)	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. 16-20	Majority of pools large-deep; very few shallow. 11-15	Shallow pools much more prevalent than deep pools. 6-10	Majority of pools small-shallow or pools absent. 0-5
4. Channel Alteration (channelization, dredging, staightening, other alterations) SCORE (____)	Channel alteration absent or minimal; stream with normal, sinuous pattern. 16-20	Some channel alteration present, usually in areas of crossings, evidence of past channel alterations, (prior to past 20 yrs) may be present, but more recent channel alteration is not present. 11-15	New embankments present on both banks; channelization may be extensive, usually in urban areas or drainage areas of agriculture lands; and >80% of stream reach channelized and disrupted. 6-10	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely. 0-5
5. Sediment Deposition SCORE (____)	Less than 20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars. 16-20	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation. 11-15	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events. 6-10	Channelized; mud, silt, and/or sand in braided or nonbraided channels; pools almost absent due to deposition. 0-5

Habitat Parameter	Category			
	Optimal	Sub-Optimal	Marginal	Poor
6. Channel Sinuosity SCORE (_____)	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. 16-20	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line. 11-15	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line. 6-10	Channel straight; waterway has been channelized for a long distance. 0-5
7. Channel Flow Status SCORE (_____)	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 16-20	Water fills >75% of the available channel; or <25% of channel substrate is exposed. 11-15	Water fills 25-75% of the available channel and/or riffle sub-strates are mostly exposed. 6-10	Very little water in channel and mostly present as standing pools. 0-5
8. Bank Vegetation Protection (score each blank) Note: determine left or right side by facing downstream. SCORE (_____) (LB) SCORE (_____) (RB)	More than 90% of the streambank surfaces covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; Vegetation disruption minimal or not evident; almost all plants allowed to grow naturally. 9-10 9-10	70-90% of the streambank surfaces covered by native vegetation; but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 6-8 6-8	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 3-5 3-5	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 0-2 0-2
9. Bank Stability (score each bank) SCORE (_____) (LB) SCORE (_____) (RB)	Banks stable; no evidence of erosion or bank failure; little potential for future problems. 9-10 9-10	Moderately stable; infrequent, small areas of erosion mostly healed over. 6-8 6-8	Moderately unstable; up to 60% of banks in reach have areas of erosion; high erosion potential during floods. 3-5 3-5	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 0-2 0-2
10. Riparian Vegetation Zone Width (score each bank riparian zone) SCORE (_____) (LB) SCORE (_____) (RB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone. 9-10 9-10	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 3-5 3-5	Width of riparian zone 6-12 meters; human activities have impacted a great deal. 3-5 3-5	Width of riparian zone <8 meters; little or no riparian vegetation due to human activities. 0-2 0-2

TOTAL SCORE (_____)

MOD 10/18/94

Stream:_________________________ PHYSICAL CHARACTERIZATION/ WATER QUALITY **Date:**______________________

Site name:_______________________ FIELD DATA SHEET **Time:**_____________________

Station Key:_______________________________ Project:___________________

Collecting Agency:_________________________ LEGAL DESCRIPTION: T Rosgen Class________________

PHYSICAL CHARACTERIZATION GPS Coordinates_______________ PDOP________

_______________ Satellites_______

RIPARIAN ZONE/INSTREAM FEATURES

Forest Field/Pasture Agricultural Residential Commercial Industrial Other:________________

Local Watershed Erosion: None Moderate Heavy

Local Watershed NPS Pollution: No Evidence Some Potential Sources Obvious Sources

Estimated Stream Width_______m Estimated Stream Depth: Riffle______m Run______m Pool______m

High Water Mark______m Velocity______ Dam Present: Yes___No____ Channelized: Yes____No_____

Canopy Cover: Open Partly Open Partly Shaded Shaded

SEDIMENT/SUBSTRATE:

Sediment Odors: Normal Sewage Petroleum Chemical Anaerobic None Other____________________

Sediment Oils: Absent Slight Moderate Profuse

Sediment Deposits: Sludge Sawdust Paper Fiber Sand Relic Shells Other____________________________

Are the underside of stones which are not deeply embedded black? Yes____ No____

Inorganic Substrate Components			Organic Substrate Components		Substrate Type
	Diameter	Percent Composition in sampling area	Substrate Type	Characteristic	Percent Composition in sampling area
Bedrock			Detritus	Sticks, Wood, Course Plant Materials (CPOM)	
Boulder	> 256 mm (10in)				
Cobble	64-256 mm (2.5-10 in)				
Gravel	2-64 mm (0.1-2.5 in)		Muck-Mud	Black, Very Fine Organic (FPOM)	
Sand	0.06-2.00 mm (gritty)				
Silt	0.004-0.06 mm		Marl	Grey, Shell Pigments	
Clay	< .004 mm (slick)				

WATER QUALITY

Temperature_____C Dissolved Oxygen_____ pH_____ Conductivity_____ Discharge_____ Other_____________

Instrument(s) Used____

Stream Type: Coldwater Warmwater

Water Odors: Normal Sewage Petroleum Chemical None Other__________

Water Surface Oils: Slick Sheen Globs Flecks None

Turbidity: Clear Slightly Turbid Opaque Water Color

Weather Conditions Number of Kick Samples________

Photograph Number_________________ Duration of Kick_____________ _____________

Length of Kick_______________ _____________

____Acceptable _____Needs revision _____Reject

Contractor Report Evaluation Form date:_________

Contractor:___________________________________
Report Title:_________________________________
Report Date:_______________
reviewed by:_____________________

QUESTIONS, REVISION REQUIREMENTS:

Subsampling

1. Did the contractor follow the specified sub-sampling procedures?

2. Are subsamples in the range of 270-330 organisms?

3. Is the proportion of the sample that the contractor subsampled documented?

Taxonomy

4. Is taxonomic resolution consistent with the SOP's?

Data Analysis

5. Is the correct set of metrics used for impairment rating?

6. Was an appropriate reference used for the analysis?

7. Did the contractor use replicate information in evaluating the level of resolution if appropriate?

8. For reports where time trends are being evaluated: Did the contractor account for any differences in taxonomic resolution between years, etc?

9. Are the metrics calculated correctly?

Report Details

10. Are the dates the samples were collected included in the report?

11. Are the report conclusions clearly summarized?

12. Are the pages numbered?

13. Is the taxa list ordered consistent with the SOP’s?

14. Are any deviations from the SOP’s explained and justified?

Other Comments: